

Identify the optimum rate and timing of tiafenacil in Michigan hop yards

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Abstract: Field trials were established to determine the optimum rate and timing of tiafenacil in hop at grower field in Benton Harbor, MI during spring 2022 and repeated in 2023 where plots received same treatments as previous year. The experiment was organized in a randomized complete block design with three replicates. Each plot will have at least 8 hop vines (4 hills). Same set of treatments were applied to each hop cultivars including Newport and Comet. In 2023, only Comet variety was used. Application timing: App A (broadcast): mid-late winter (3/15/2022; 3/21/23), app B (broadcast): Spring burndown approximately 2-3 weeks prior to hops training (4/26/2022; 4/27/23), app C (directed): Hops 6-8 feet tall (6/9/2022; 6/13/23), and app D (directed): Hops 12-16 feet tall (6/29/2022; 6/27/23). Treatment 01 was untreated weedy. Treatment 02 Aim (0.031 lb ai/a) and COC (1% v/v) was applied at winter, spring, PO1, and PO2 application timings. Treatment 03 Tiafenacil 1X (0.044 lb ai/a) and treatment 04 Tiafenacil 2X (0.088 lb ai/a) were applied at winter, PO1, and PO2 application timings; both received a application of Aim and COC (1% v/v) at the spring application. Treatment 05 Tiafenacil 1X and treatment 06 Tiafenacil 2X were applied at spring, PO1, and PO2 application timings; both received a application of Aim and COC (1% v/v) at the winter application. All treatments with Tiafenacil also included MSO (1% v/v) and Bronc (AMS 1% v/v). In both cultivars, weed control was reported similar from all treatments after winter and spring application and mainly grasses survived. After PO1 and PO2, higher broadleaf and grass control reported from tiafenacil application as compared to Aim. There was no difference reported for hop height and yield with respect to the treatments. Overall, Newport cultivar reported more sensitive to tiafenacil applications as compared to Comet cultivar. Both cultivars, recovered really well from winter and Spring herbicide injury. Two sequential POST applications of Tiafenacil (regardless of rates) during season significantly reduced lower hop foliage (higher injury to low hop vines) as compared to Aim. At the same time, two sequential POST applications of Tiafenacil (regardless of rates) cause some injury to the upper foliage as well; however, plants recovered from injury and no impact on hop height and yield was reported. In terms of hop plant injury, three sequential applications of Spring, PO1 and PO2 caused slightly higher injury as compared to winter, PO1, and PO2 application. Overall these results show that tiafenacil (0.044 and 0.088 lb/ac) has potential to use in hop yards for managing the lower vine foliage and weed control.

Technical Summary: Field trials were established at grower field in Benton Harbor, MI during spring 2022 and repeated in 2023 where plots received same treatments as previous year. The experiment was organized in a randomized complete block design with three replicates. Each plot will have at least 8 hop vines (4 hills). Same set of treatments (mentioned in table 1) were applied to each hop cultivars including Newport and Comet. In 2023, only Comet variety was used.

Application timing:

1. App A (broadcast): mid-late winter (3/15/2022; 3/21/23)
2. App B (broadcast): Spring burndown approximately 2-3 weeks prior to hops training (4/26/2022; 4/27/23)
3. App C (directed): Hops 6-8 feet tall (6/9/2022; 6/13/23)

4. App D (directed): Hops 12-16 feet tall (6/29/2022; 6/27/23)
5. Use 2 nozzle boom for directed sprays (overlap spray pattern across lower 2 ft of the hop plants to create a broadcast spray pattern covering 5.3”) and a 4-nozzle boom for broadcast sprays.

Data Collection:

1. **Crop injury:** was assessed 14 and 28 days after hop plants break dormancy (before or close to B application). Crop injury was also assessed on the main shoot above the sprayed portion at 7, 14, and 28 days after each post-directed application. Type of injury reported was stunting, stand loss, leaf burn, and chlorosis)
2. **Defoliation:** Response of lower hops foliage was assessed on the sprayed portion of the plants at 7, 14, and 28 days after each post-directed application.
3. **Weed Control:** Weed control data was collected at 5-7 days after each broadcast application (A and B) and 14 and 28 days after hop plants break dormancy. Weed control was also collected 7, 14, and 28 days after each post-directed application (C and D applications).
4. **Crop height:** For each vine in each plot before each post-directed application (C and D) and 28 days after the last application.
5. **Harvest:** plant biomass per plot was measured on 8/30/2022 and 2023 harvest will be done in last week of August.

Table 1. Treatment application made in hop yard during 2022 and 2023.

Trt No.	Treatment Name	Form Conc	Form Unit	Rate Rate	Rate Unit	Appl Timing
1	Untreated-Weed					
2	Aim		2 LBA/GAL	0.031 lb ai/a		ABCD
	COC	100 %		1 % v/v		ABCD
3	Reviton	2.83 LBA/GAL		0.044 lb ai/a		ACD
	MSO	100 %		1 % v/v		ACD
	Bronc (AMS)	38 %AW/W		1 % v/v		ACD
	Aim		2 LBA/GAL	0.031 lb ai/a		B
	COC	100 %		1 % v/v		B
4	Reviton	2.83 LBA/GAL		0.088 lb ai/a		ACD
	MSO	100 %		1 % v/v		ACD
	Bronc (AMS)	38 %AW/W		1 % v/v		ACD
	Aim		2 LBA/GAL	0.031 lb ai/a		B
	COC	100 %		1 % v/v		B
5	Aim		2 LBA/GAL	0.031 lb ai/a		A
	COC	100 %		1 % v/v		A
	Reviton	2.83 LBA/GAL		0.044 lb ai/a		BCD
	MSO	100 %		1 % v/v		BCD
	Bronc (AMS)	38 %AW/W		1 % v/v		BCD
6	Aim		2 LBA/GAL	0.031 lb ai/a		A
	COC	100 %		1 % v/v		A
	Reviton	2.83 LBA/GAL		0.088 lb ai/a		BCD
	MSO	100 %		1 % v/v		BCD

Bronc (AMS)	38 %AW/W	1 % v/v BCD
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Reviton = tiafenacil

Results and discussion:

Results from Comet Cultivar (2022):

Weed control was reported similar from all treatments after winter application and mainly grasses survived (30 DAA1). Initially at 9 DAA2 (May 5th) significantly higher grass control observed from treatment 5 and 6; but no difference in control were reported at 16 and 30 DAA2 (May 12 and 25). Other broadleaf weeds control was reported very good and similar from all the treatments after spring application until the first PO1 application (rating May 5, 12, and 25th). At 7 DAA4 (June 30th), grass control reported higher from tiafenacil (treatments 3 to 6) application as compared to Aim. Similar trend was reported for weed control for rest of the ratings, but level of control reduced with time.

Higher level of crop injury reported from spring application of tiafenacil (0.044 and 0.088 lb/ac; treatment 5 and 6) than spring application of Aim at 9 and 16 DAA2 (May 5 and 12 ratings).

Hop plants recover from the spring application injury by 30 DAA2 (May 25 rating) and all the treatments has similar crop growth. At 5 DAA3 (June 14th), injury to high hop vines was reported from 15 to 33% from tiafenacil treatments and 35% from Aim. Injury to lower hop foliage was reported higher from both tiafenacil rates (trt 3 to 6; 52 to 72%) as compared to Aim. At 7 DAA4 (June 30th), highest injury (40%) to high hop vines was reported from treatment 3. At 7 DAA4, injury to lower hop foliage was reported significantly higher (>90%) from both tiafenacil rates (trt 3 to 6) as compared to Aim (32%). Similar trend was reported for injury ratings for rest of the ratings but the level of injury reduced with time. There was no difference reported for hop height and yield with respect to treatments.

Similar results are expected from 2023.

Results from Newport cultivar (2022):

Weed control was reported similar from all treatments after winter application and mainly grasses survived (30 DAA1; April 14). Initially at 9 DAA2 (May 5th) higher grass control observed from treatment 4, 5, and 6; but no difference between treatments and reduced level of grass control was reported at 16 and 30 DAA2 (May 12 and 26). Other broadleaf weeds control was reported very good and similar from all the treatments after spring application until the first PO1 application (rating May 5, 12, and 26th). At 7 DAA4 (June 30th), grass control reported higher from tiafenacil (treatments 3 to 6) application as compared to Aim. Similar trend was reported for weed control for rest of the ratings, but level of control reduced with time.

Higher level of crop injury reported from spring application of tiafenacil (0.044 and 0.088 lb/ac; treatment 5 and 6) than spring application of Aim at 9 and 16 DAA2 (May 5 and 12 ratings). Hop plants recover from the spring application injury by 30 DAA2 (May 26 rating) except from treatment 5 that showed 37% crop injury. At 5 DAA3 (June 14th), injury to high hop vines was reported from 12 to 37% from tiafenacil treatments and 3% from Aim. Injury to lower hop foliage was reported higher from two sequential (Spring and PO1) tiafenacil applications (trt 5 and 6; 78%) as compared to Aim and two tiafenacil applications (Winter and PO1). At 7 DAA4 (June 30th), injury to high hop vines was reported from 0 to 7% from all the treatments. At 7 DAA4, injury to lower hop foliage was reported significantly higher (>88%) from both tiafenacil rates (trt 3 to 6) as compared to Aim (32%). Similar trend was reported for injury ratings for rest of the ratings but the level of injury reduced with time. There was no difference reported for hop height and yield with respect to treatments.

Overall, Newport cultivar reported more sensitive to tiafenacil applications as compared to

Comet cultivar. Both cultivars, recovered really well from winter and Spring herbicide injury. Two sequential POST applications of tiafenacil (regardless of rates) during season significantly reduced lower hop foliage (higher injury to low hop vines) as compared to Aim. At the same time, two sequential POST applications of tiafenacil (regardless of rates) cause some injury to the upper foliage as well; however, plants recovered from injury and no impact on hop yield was reported. In terms of hop plant injury, three sequential applications (Spring, PO1 and PO2) caused slightly higher injury as compared to winter, PO1, and PO2 application. Overall these results show that tiafenacil (0.044 and 0.088 lb/ac) has potential to use in hop yards for managing the lower vine foliage and weed control.